application. Applicants have amended the independent claims to clearly define the elements of the module being claimed. In view of the amendments to the claims and for the following reasons, reconsideration of the rejection of claims 1-14 as being unpatentable under 35 U.S.C. § 103(a) over Tohyama et al, U.S. Patent No. 5,642,371, in view of Epler et al, U.S. Patent No. 4,962,057 is respectfully requested.

In particular, as pointed out in the Interview, the claimed invention is directed to a module for optical communication. A module for optical communication is shown in Fig. 5, for example. The module has a modulator integrated semiconductor laser including a semiconductor laser active region and an optical modulation region. The semiconductor laser active region has a multiple quantum well structure having quaternary mixed crystal layers selected from the group consisting of quaternary compounds of In, Ga, Al and As or quaternary mixed compounds of In, Ga, N and As. As a result of using the specified quaternary mixed compounds, the temperature of the semiconductor laser active region or the temperature of a component in thermal contact with the semiconductor laser active region for holding the temperature of the semiconductor laser active region can be set to 30° to 35°C or higher during operation of the semiconductor laser and the optical modulator. That is, by using the specified

quaternary compound semiconductor material containing Al or N, it is possible to ensure adequate optical power at a high temperature, which enables low power consumption of a cooling element controlling the temperature of the modulator integrated laser.

The reason power consumption of the cooling element controlling the temperature of the modulator integrated laser can be reduced is explained in the specification with reference to Fig. 1 of the present application. See page 4, lines 4-12 of the specification. Specifically, Fig. 1 shows that as the difference in temperature between the case temperature (temperature of the outer wall of the module 74 in Fig. 12 or case 5 in Fig. 5) and the temperature of the chip (e.g., modulator integrated semiconductor laser) increases, the power consumption of a cooling element controlling the temperature of the modulator integrated laser increases. Therefore, since the specified quaternary compound semiconductor material containing Al or N enables the temperature of the semiconductor laser active region to be set at an operating temperature of at least 30°C, there is a resultant decrease in temperature difference that leads to lower power consumption of the cooling element controlling the temperature of the modulator integrated laser.

As explained in the specification, the optical power of a modulator integrated laser typically decreases as its temperature increases because of an overflow of injection current at high temperature. See page 16, lines 8-10 of the specification. However, this is not a problem with the modulator integrated laser of the present invention because the claimed multiple quantum well structure having the specified quaternary compound semiconductor material containing Al or N has a band offset value of the conduction band that is larger than the valence band offset value, as explained at page 10, lines 12-21 of the specification with reference to Fig. 3. Accordingly, Applicants have amended the independent claims to include this limitation, which is not shown or suggested by the art of record.

The 35 U.S.C. § 103(a) rejection relies upon Tohyama for disclosing the optical communication module of the invention. However, as recognized by the Examiner, Tohyama does not disclose that the temperature of the semiconductor laser active region is set to at least 35 C. Rather, the rejection relies upon Epler for disclosing this aspect of the claimed combination. As pointed out in the Interview, although, the cited portion of the Epler reference merely discloses that the "operating temperature" of AlGaAs is higher than an operating temperature of GaAs because the Al content in AlGaAs causes a

slower evaporation rate since GaAs has a higher vapor pressure than AlGaAs. See col. 10, lines 55-59 of the reference.

The operating temperature that is referred to in Epler, however, is not equivalent to the temperature of a semiconductor laser active region or the temperature of a component in thermal contact with the semiconductor laser active region for holding the temperature of the semiconductor laser active region that is set to 35 C or higher during operation of the semiconductor laser active region and optical modulation region, as claimed by Applicants. The meaning of "during operation" as set forth in claims 1, 5 and 11 is explained in the specification as a state in which optical signals are transmitted from the laser and a sufficient eye opening is obtained after fiber transmission over a desired distance. See page 17, lines 9-12 of the specification. On the other hand, the operating temperature referred to by Epler is an operating temperature of a crystal growth device. See col. 10, lines 43-59 of Epler. Therefore, the reference does not suggest that Applicants' claimed temperature limitation is obvious to one having ordinary skill in the art and therefore the 35 U.S.C. § 103(a) rejection of claims 1-14 should be withdrawn.

Applicants have amended the specification to add reference number 28 at page 22, line 14 which describes a polyimide resin. Also, Applicants note that reference number

24 designates a cross section line from which the sectional view shown in Fig. 8 is taken. See page 21, lines 1 and 2 (from the bottom of the page) of the specification. Reference numbers 11, 110 and 111 have been deleted from the drawings. Accordingly, the objection to the drawings should be overcome.

In view of the foregoing amendments and remarks, reconsideration and reexamination are respectfully requested.

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MARKED UP VERSION OF REPLACED PARAGRAPH(S) OF THE SPECIFICATION

Page 17, the marked-up paragraph reads:

Fig. 4 illustrates a graph showing a relation between a laser chip temperature and an optical power. A curve 200 shows a semiconductor laser chip using an InGaAlAs- MQW and a curve 201 shows a semiconductor laser chip using an InGaAsP - MQW. Actually, as shown in Fig. 4, the output power less decreases in this invention even when the temperature of the laser active layer is high. Thus, the chip temperature and the environment temperature of the chip can be elevated to a higher temperature during operation of the module. "During operation of module" means a state where optical signals are transmitted from the laser and a sufficient eye opening is obtained after fiber transmission over a desired distance. Accordingly, this state means that the laser, the modulator, the temperature control system and the wavelength adjusting system are operated as designed under electric power supply. Further, "environmental temperature of the chip" indicates a temperature of a portion between a temperature control element such as a Peltier cooler for temperature control of the chip for physically holding the chip and the chip. Actually, the temperature indicated by a thermister in contact with a carrier for holding the chip is defined as a chip temperature

as shown in Fig. 5 and Fig. 6. Actually, the temperature of an optical transmission device on which an optical transmission module is disposed often rises to 40 - 50°C or higher. Details for Fig. 5 and Fig. 6 will be described later.

Page 22, the second full paragraph, the marked-up paragraph is:

A stripe of 1.7 μm width is formed at a depth of 1.9 μm to the thus formed semiconductor layer 30, to constitute a waveguide. A protection film 29 for protecting the waveguide is formed, for example, with SiO_2. For forming the p-type electrode 22, other portions than the waveguide stripe are flattened with a polyimide resin 28. Then, the p-type electrode 22 is formed. Finally, an n-type electrode 33 is formed at the rear face of the semiconductor substrate.

MARKED UP VERSION OF REWRITTEN CLAIMS

1. (Amended) A module for optical communication having a modulator integrated laser includes a semiconductor laser active region and~~,~~ an optical modulation region for modulating the light from the semiconductor laser active region; and a temperature control region for controlling ~~the~~ temperature ~~control~~ of at least the optical modulation region, said ~~in which the~~ semiconductor laser active region having~~has~~ a multiple-quantum well structure having at least two quaternary mixed crystal layers in which a band offset of a conduction band is larger than a band offset of a valence electron band, said at least two quaternary mixed crystal layers being selected from the group consisting of quaternary mixed compounds of In, Ga, Al and As and a quaternary mixed compounds of In, Ga, N and As, wherein a ~~and at least the~~ temperature of a~~the~~ semiconductor laser active region or a~~the~~ temperature of a component in thermal~~ly~~ contact with the semiconductor laser active region for holding the temperature of the semiconductor laser~~layer~~ active region is ~~can be~~ set to 35°C or higher during operation of the semiconductor laser active region and the optical modulation region.

2. (Not Amended) A module for optical communication as defined in claim 1, wherein the temperature control component is a heating component or a heater.

3. (Not Amended) A module for optical communication as defined in claim 1, wherein the temperature control component is disposed without having a cooling component.

4. (Amended) A module for optical communication as defined in claim 1, wherein the temperature of at least the semiconductor laser active region or the temperature control component in thermal~~ly~~ in ~~contact~~ with the semiconductor laser active region for holding the semiconductor laser active region is ~~can be~~ set to 30°C or higher during operation of the semiconductor laser active region and the optical modulator region.

5. (Amended) A module for optical communication having a modulator integrated laser includes a semiconductor laser active region having at least two active regions~~,~~ and an optical modulation region for modulating the light from the semiconductor laser active regions; and a temperature control component for temperature control of at least the optical modulation region, and a control component for controlling the wavelength of the light emitted from the semiconductor laser active region, said ~~in which the~~ semiconductor laser active region having~~has~~ a multiple-quantum well structure having at least two quaternary mixed compounds layers in which a band offset of a conduction band is larger than a band offset of a valence electron band, said at least two quaternary mixed crystal layers being selected from the group

consisting of quaternary mixed compounds of In, Ga, Al and As and a quaternary mixed crystals of In, Ga, N and As, wherein~~and the~~ a temperature of at least the semiconductor laser active region or a~~the~~ temperature of the component in thermal~~ly~~ contact with the semiconductor laser active region for holding the temperature of the semiconductor laser ~~layer~~ active region is~~can be~~ set to 35°C or higher during operation of the semiconductor laser active region and the optical modulation region.

6. (Not Amended) A module for optical communication as defined in claim 5, wherein the temperature control component is a heating component or a heater.

7. (Not Amended) A module for optical communication as defined in claim 5, wherein the temperature control component is disposed without having a cooling component.

8. (Amended) A module for optical communication as defined in claim 5, wherein the temperature of at least the semiconductor laser active region or the component in thermal~~ly in~~ contact with the semiconductor laser active region for holding the temperature of the semiconductor laser active region ~~can be~~ is set to 30°C or higher during operation of the semiconductor laser active region and the optical modulation region.

9. (Amended) A module for optical communication as defined in claim 5, wherein the semiconductor laser active

~~chip~~ region and the optical modulation region are constituted, respectively, with semiconductor chip regions separated~~ly~~ from each other.

10. (Amended) A module for optical communication as defined in claim 5, wherein the semiconductor laser active~~chip~~ region and the optical modulation region are constituted as semiconductor chip regions integrated on one same ~~identical~~ substrate.

11. (Amended) An optical transmission -module ~~for optical communication~~ having a modulator integrated laser includes a semiconductor laser active region~~,~~ and a plurality of optical modulation regions for modulating the light from the semiconductor laser active region, a multiplexer for multiplexing the outputted light and a temperature control component for temperature control of at least the optical modulation region, said ~~in which the~~ semiconductor laser active region has a multiple-quantum well structure having at least two quaternary mixed crystal layers in which a band offset of a conduction band is larger than a band offset of a valence electron band, said at least two quaternary mixed crystal layers being selected from the group consisting of quaternary mixed compounds of In, Ga, Al and As and a quaternary mixed compounds of In, Ga, N and As, and the temperature of at least the semiconductor laser active region or the temperature of the component in thermal~~ly~~ contact with the semiconductor laser active region for holding the temperature of the semiconductor

laser~~layer~~ active region is~~can be~~ set to 35°C or higher during operation of the semiconductor laser active region and the optical modulation region.

12. (Not Amended) A module for optical communication as defined in claim 11, wherein the temperature control component is a cooling component or a heater.

13. (Not Amended) A module for optical communication as defined in claim 11, wherein the temperature control component is disposed without having a cooling component.

14. (Amended) A module for optical communication as defined in claim 11, wherein the temperature of at least the semiconductor laser active region or the component in thermal~~ly in~~ contact with the semiconductor laser active region for holding the temperature of the semiconductor laser active region is ~~can be~~ set to 30°C or higher during operation of the semiconductor laser active region and the optical modulator region.